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Role of surface mixing in phytoplankton distribution in a stratified reservoir

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We investigated convection due to surface cooling and mixing due to wind shear stress and their roles as agents for the transport of phytoplankton cells in the water column by carrying out two daily surveys during the stratified period of the Sau reservoir. Green algae, diatoms, and cryptophyceae were the dominant phytoplankton communities during the surveys carried out in the middle (July) and end (September) of the stratified period. We show that a system with a linear stratification and which is subject to weak surface forcing, with weak winds $<$4 m s^{-1} and low energy dissipation rate values of the order of 10^{-8} m^{2}s^{-3}or lower, allows the formation of thin phytoplankton layers. These layers quickly disappear when water parcels mix because there is a medium external forcing (convection) induced by the night surface cooling, which is characterized by energy dissipation rates in the order of $\sim 5 \times 10^{-8}$ m^{2}s^{-3}. During both surveys the wind generated internal waves during the whole diurnal cycle. During the day, and due to the weak winds, phytoplankton layers rise in the water column up to a depth determined by both solar heating and internal waves. In contrast, during the night phytoplankton mixes down to a depth determined by both convection and internal waves. These internal waves, together with the wind driven current generated at the surface, seem to be the agents responsible for the horizontal transport of phytoplankton across the reservoir.